Climate change and land clearing: a short note

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Summary of Research Findings

Climate change is the most urgent environmental, economic and social issue facing Australia and the world. The concentration of anthropogenic greenhouse gases has grown rapidly in recent decades, and is expected to continue well into the 21st century, increasing the risk of dangerous climate change. The options for significant reduction of emissions are still being debated and as yet there is no global agreement in place. However it is not widely appreciated that the world is facing unavoidable warming even if greenhouse emissions were reduced to zero (Solomon *et al.* 2009). Australia is a region already severely impacted by climate change, reflected in warmer and drier conditions with increased frequency of droughts, heatwaves, bushfires and floods. Climate change projections for Australia show potential for significant changes, especially for high emission scenarios, with a projected temperature increase by 3-7°C by the end of the 21st century (CSIRO & BOM 2007). Climate extremes such as bushfires, heatwaves and droughts are also projected to increase (Garnaut 2008).

Climate change is a multi-dimensional issue where multiple forces and their interactions are impacting on the climate system (IPCC 2007; McAlpine *et al.* 2009). Globally, the conversion and modification of terrestrial ecosystems through human land use and land cover change is increasingly recognised as a second order forcing behind climate changes over the past 200 years. However, land use and land cover change appears to have stronger regional effects, especially in the tropics and sub-tropics. For Australia, historical clearing of native vegetation has recently been shown to be an important factor influencing the climate, especially eastern Australia (McAlpine *et al.* 2007). McAlpine *et al.* (2007) showed a statistically significant warming, especially during summer, of 0.1-0.6°C in eastern Australia, while the mean summer rainfall showed a statistically significant decrease by 4-8% in southeast Australia. The analysis also showed historical land clearing has contributed to hotter and longer droughts during El Niño years, such as the severe drought of 2002/2003. In a subsequent study, Deo *et al.* (2009) found an increase in the number of dry and hot days, a decrease in daily rainfall intensity and wet day rainfall, and an increase in the decile-based drought duration index for modified land cover conditions in eastern Australia. These changes were statistically significant for all years, and especially pronounced during strong El Niño events.

The modelling studies have important implications for native vegetation and Natural Resource Management (NRM) in Australia. The problem of historical land clearing exacerbating climate extremes is likely to be compounded by the interaction of contemporary land use pressures and an emerging trend towards a hotter and more-drought prone climate driven by increased anthropogenic greenhouse gases. The large-scale restoration of native ecosystems has the potential to ameliorate regional climate change while providing other ecological services such as biodiversity, clean air and water. However, we currently do not know to what extent such actions will modify temperature and rainfall patterns directly under global warming. This question requires urgent consideration to inform climate policies if they are to lead toward more integrated climate mitigation and sustainable land use outcomes.

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